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Maintenance activities for the Release 9 version of the NET-2 Network
Analysis Program are described. These activities include correction
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in the application of NET-2 as directed by the Harry Diamond
Laboratories.

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MAINTENANCE FOR THE
NET-2 NETWORK ANALYSIS PROGRAM

FINAL REPORT

PREPARED BY:

THE BDM CORPORATION
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APRIL 1977

PREPARED FOR:

U.S. ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND

HARRY DIAMOND LABORATORIES

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UNDER CONTRACT NO. DAAG39-76-C-0086

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application of NET-2 as directed by The Harry Diamond Laboratories.

PREFACE

This report was prepared for the Harry Diamond Laboratories, Adelphi, Maryland, by The BDM Corporation under Contract DAAG39-76-C-0086. This document constitutes the final report on maintenance activities for the Release 9 version of the NET-2 Network Analysis Program.

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NET-2 MAINTENANCE ACTIVITIES

During the contract period maintenance of the Release 9 version of
NET-2 was provided. The maintenance activity consists of detecting, isolat-
ing, and correcting errors in the program as well as incorporating minor
improvements into the program which increase the program's usefullness. In
addition, inquiries were answered concerning the application of NET-2 to
specific problems, assistance was provided to users experiencing difficulties
in using the program, and copies of the program were distributed to qualified
requestors.

A specific maintenance activity begins in one of two ways: either a
user has tried to apply NET-2 to a particular problem and has obtained
erroneous results or experienced operating difficulties, or a coding or
conceptual error is discovered as a byproduct of maintaining or improving
the program.

If the user reports difficulty, the first step is to determine that he
is not attempting to apply the program to a situation which is beyond the
intended range of application for which the program was designed. Next, it
is necessary to verify that the master copy of the program experiences the
same or similar difficulty; this step is necessary to eliminate error reports
which are due to incorrectly or inadequately maintained copies of NET-2 at
the user's installation, and to eliminate errors which are caused by peculiar-
ities in the user installation operating system, support software, and hardware.

Once the presence of the error has been confirmed it is necessary to
isolate the specific cause of the difficulty. Errors are frequently reported
while attempting to run very complex problems; thus, it is desirable to be
able to simplify the test problem while retaining the error. At some point,
by means of carefully controlled debugging runs and occasional educated guesses,
the exact cause of the error is isolated.

The next step involves correction of the error. In general, there are
three types of errors: 1) conceptual errors in the logical structure of the
program, 2) coding errors in the implementation of the logical structure on

25 February 1977

<u>MEMORANDUM</u>

TO: NET-2 Maintenance Personnel

FROM: A. F. Malmberg

SUBJECT: Correction in Subroutine DELAY

An error has been isolated in subroutine DELAY of Release 9 of NET-2. This error can result in a divide by zero operation under certain special conditions involving propagation of a zero valued signal segment through the system element DELAY. The correction of the error eliminates the possibility of dividing by zero without affecting the intended operation of the DELAY element.

The attached sheet shows the relevant section of the corrected listing of subroutine DELAY (CDC 6000 version). The change is indicated by a black mark in the left margin. Please update your copy of this subroutine as indicated.

Corrected Listing of DELAY (6000 Version) 25 February 1977 Sheet 1 of 1


```
2560 IF(J.EQ.KBP) GO TO 2600

     QMAX=ABS(Q(K))-TI
     IF(QMAX.EQ.0.)GO TO 2570
     E=ABS( (Q(K+1)-YI)*(ABS(Q(J))-TI)/QMAX + YI-Q(J+1) )
     IF(E.GE.EPS) GO TO 2580
2570   IE=IE+1
     GO TO 2620
2580 IF(IE.NE.0) GO TO 2600
```


Figure 1. Example of NET-2 Maintenance Memo

a specific computer and programming system, and 3) numerical difficulties encountered in the solution of a particular problem. Errors of the second type are the easiest to correct. Errors of the first type usually involve more extensive changes than just the correction of a single coding statement. Errors of the third type generally involve very extensive changes since alternate numerical techniques must be devised, tested, and implemented.

Following the correction of the error a memo is published which describes the nature of the error, its probable effects on the user, and the steps to be taken to eliminate the error. A typical error correction memo is shown in Figure 1. The master copy of the program is corrected so that all future copies of NET-2 will not contain the error.

The error isolation and correction procedure outlined above is normally conducted using the CDC 6000 version of NET-2. Since the 6000 version precedes the IBM 360 version in historical development, any errors in the 6000 version will probably also exist in the 360 version. Errors in the 360 version which do not occur in the 6000 version are generally confined to coding errors and do not involve logical errors or difficulties with numerical techniques. The 360 version is corrected using the published memos as the initiating step. Any errors which are initially reported with the 360 version are checked against the 6000 version as a first step.

During the contract period a total of three memos were published detailing corrections for errors in NET-2. These memos resulted from inquiries by users experiencing some kind of difficulty. In some instances the inquiry resulted from incorrect usage of NET-2, or an attempt to apply the program to a situation beyond the design capabilities. Some inquiries represented bona fide errors which did not exist in the master copy but were due to improper maintenance by the user or peculiarities due to nonstandard operating systems and equipment. The three published memos represent the distillation of all of the inquiries and report only the identified bona fide errors which existed in the master copy. Normally, only one error is reported in each memo in order that error correction may be done in modular fashion.

The specific errors which were isolated, corrected, and reported in memos during the contract performance periods were:

(1) Difficulty was experienced by some users under recent releases of CDC operating systems in the correct functioning of subroutine RELOC. RELOC is responsible for the dynamic relocation of specified element subroutines during the actual solution phase of NET-2. Only those element subroutines which are actually needed for the solution are relocated; thus great savings in core storage are achieved by dynamically relocating these at the appropriate point in the computation. Because of certain loader dependent assumptions in the original NET-2 implementation, subroutine RELOC would loop under some of the recent versions of the CDC operating system. The revised coding for RELOC is expected to operate successfully for all versions of the CDC operating system.

(2) Dynamic data compression techniques are used in the element subroutines DELAY and TLINE, which model the time delay and transmission line elements, respectively. Under certain conditions an error common to both of these subroutines would cause a divide by zero operation while attempting to perform data compression on information in the delay buffers for these elements.

Usage of the newly developed digital logic capability in NET-2 revealed several errors. These errors were primarily associated with the hierarchical aspects of time delay runouts in nested digital logic modules. No update memos were published on these errors since this feature of NET-2 has not yet been publicly distributed. The digital logic module feature will be distributed as part of the Release 10 version of NET-2.

A number of miscellaneous tasks were performed on Release 9 in preparation for the Release 10 version. These tasks were primarily concerned with overall program compatibility between previous program conventions and organization, and that required to support Release 10.

The development of an interim version of Release 10, designated as Release 9.1, revealed several errors in old coding which were inadvertently introduced during the production of Release 9.1. These errors were corrected. Since Release 9.1 has not been publicly distributed, no update memos were issued.

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Some effort was expended in reestablishing the master file for Release 9 which is maintained at the Naval Surface Weapons Center. The master file was inadvertently destroyed by CDC maintenance personnel in a freak accident. The regeneration of the master file was additionally complicated when it was discovered that the immediate backup tape version could not be read. The master file was successfully regenerated through a series of updates on an old tape copy.

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